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Features of Diastolic Function of the Right Ventricle in Patients with Arterial Hypertension

Amirova Shokhida Abdukodirovna
Samarkand State Medical University

Annotation: Arterial hypertension (AH) currently remains one of the most important problems in cardiology. This is due to high cardiovascular morbidity, early disability and mortality, and is also characterized by widespread prevalence.

Key words: Hypertension, arterial hypertension, diastolic dysfunction, right ventricle, echocardiography.

Introduction. Myocardial remodeling remains a significant factor worsening the course and prognosis of hypertension. While left ventricular (LV) remodeling in hypertension has been fairly well studied, much less attention has been paid to the state of the right ventricle in hypertension. Impairments in the diastolic function of the right ventricle in patients with heart failure are an independent prognostic factor for survival, and the use of tissue Dopplerography makes it possible to identify new informative parameters of diastolic dysfunction (DD), as well as prove its connection with the development of pulmonary hypertension [1,2, 3]. Despite the proven opinion that the risk of death from cardiovascular diseases increases with the combination of heart failure (HF) and hypertension, myocardial remodeling in hypertension associated with the addition of HF has also been insufficiently studied. Adaptive processes in the heart during the development of HF against the background of long-term hypertension have their own characteristics, manifested in impaired right ventricular (RV) DD. Early diagnosis of changes in the heart in hypertension is of great practical interest, which makes it possible to take timely preventive measures and carry out treatment. As a rule, in hypertension, the LV is affected first and to a greater extent; from the very beginning of the disease, the main load falls on it.[3,4,5] It should be noted that diastolic function, being a complex process consisting of numerous interrelated factors, depends on such indicators as: age, gender, body surface area, respiratory phase, ventricular myocardial mass, heart rate, pre - and afterload. Using various research methods, it has been established that the pancreas in hypertension also undergoes hypertrophy, disorders of its contractility and clinically pronounced insufficiency develop [4,6,7].

Purpose of the study: To study the diastolic function of the right ventricle in patients with various stages of hypertension and with the addition of heart failure of functional classes II-III.

Materials and methods of research. We examined 71 patients with hypertension. All examined were subjected to a comprehensive examination in order to exclude symptomatic hypertension and other diseases. The diagnosis of hypertension was made on the basis of the criteria proposed by the WHO expert committee. The study included patients with stage II-III hypertension - 31 women (43.66%) and 40 men (56.3%) (aged from 25 to 63 years). Antihypertensive medications were stopped 24 hours before the start of the study.

The diagnosis of stage II hypertension was established in 46 patients. The average age of the patients was 42.3±4.2 years. Of these, 21 were women (average age 44.7 ± 4.7 years) and 25 men (average age 37.4 ± 4.7 years). Patients with diseases that significantly affected the systolic and diastolic function of the right ventricle, such as diabetes mellitus, obesity, chronic nonspecific pulmonary diseases, tricuspid regurgitation of more than II degree, tachycardia with heart rate were excluded from the study. more than 100 beats per minute and atrial fibrillation.

Results and discussion. All hypertensive patients we examined showed signs of left ventricular hypertrophy on the ECG and the presence of hypertensive retinal angioretinopathy. The diagnosis of stage III hypertension was established in 25 patients with target organ damage. The average age of the patients was 57.1 ± 4.3 years. Of these, 10 were women (mean age 55.9 ± 4.6 years) and 15 men (mean age 62.4 ± 4.5 years). Of these, 7 patients (2 women and 5 men, average age 63.3 ± 4.7 years) had a history of transient cerebrovascular accidents, the remaining 18 (6 women and 12 men, average age 56.2 ± 5 ,3 years) – documented IHD. By gender and age, the groups of patients with stage II and III hypertension did not differ significantly. The combination of hypertension and coronary heart disease was noted in 10 patients with stage II hypertension (21.7%) (2 women and 8 men, average age 54.3 ± 2.6 years) and in 15 patients with stage III hypertension (60%) (7 women and 8 men, average age 61.2 ± 7.3 years). The diagnosis of coronary heart disease in patients with hypertension was made according to the criteria recommended by WHO [2]. The duration of hypertension was 13.4 ± 3.2 years, the duration of a stable increase in blood pressure was 9.7 ± 3.8 years. In 38 examined patients (53.5%), complaints of headaches were revealed; 21 patients (29.5%) complained of dizziness; pain in the left half of the chest was noted in 30 patients (42.2%).

During auscultation, almost all examined patients heard an accent of the second tone over the aorta. In patients with stage III hypertension, a trend towards a decrease in the ejection fraction (EF) of the right ventricle was determined. Other clinical parameters between the subgroups practically did not differ. Comparative clinical characteristics of patients depending on the degree of rise in diastolic blood pressure are reflected in Table.1. Right ventricular systolic function did not differ significantly between subgroups.

Table 1 Clinical characteristics of patients with various degrees of elevation of diastolic pressure.

	Mild (n=25)	Moderate (n=37)	High(n=9)
Age of patients	63,3± 5,3	65,3± 12,3	68,4± 13,7
Duration of illness	13,8+6,5	14,7 ±3,6	15,8±7,8
Duration of stable flow	9,7±4,5	9,9±5,6	10,2±4,6
SBP	153,5±8,7**	168,6±9,7	195,6±9,4
DBP	98,6+7,8**	110,8±4,7	195,8±4,8
FCHF	1,9±0,3	1,8±0,3	2,0±0,4
RV EF, %	55,4±8,7	66,7±10,8	58,5±7,7
Stroke volume RV, ml	62,1±5,3	57,6±4,7	53,3±5,6

An analysis of the parameters of RV diastolic function was carried out depending on the level of increase in DBP between patients with mild and high hypertension. At the same time, significant differences were identified that concerned the ratio of the maximum filling speed to the maximum expulsion rate (MER) with a tendency for the time of the rapid filling phase to increase and the contribution of the rapid filling phase in the diastole of the right ventricle, which is due to the initial signs of diastolic dysfunction of the right ventricle with a decrease in the maximum filling speed and a moderate increase in the contribution of right atrial systole (RAS) to right ventricular filling. For other indicators, the differences turned out to be statistically insignificant. Indicators of relaxation and filling of the right ventricle between patients with a mild and moderate increase in blood pressure did not differ significantly, except for patients with a moderate increase in diastolic blood pressure. When analyzing the diastolic function of the right ventricle, depending on the stage of hypertension, the following indicators were identified (Table 1).

Upon further study of diastolic function in patients with stage II hypertension, it was revealed that in 31 patients (40.8%) there was a “pseudonormal” type of diastolic disturbances, consisting in approaching the normative indicators of the maximum filling rate, as well as in the normalization of the contribution of the system. tols of the atrium

Thus, LV diastolic function depends on the level of blood pressure and/or the presence of myocardial hypertrophy, but also on neurohumoral changes that are characteristic of the initial stages of hypertension. The identified data show the processes of myocardial hypertrophy not only of the left, but also of the right ventricle. The development of diastolic disorders in the right ventricle begins with a decrease in the maximum filling rate and a compensatory increase in pressure in the right atrium. These disturbances are significant in comparison with the pseudonormal type of diastolic dysfunction. The significant nature of these changes and the relatively high number of patients with this type of diastolic disorders among patients with stage II hypertension determine a downward trend maximum filling rate (MSF) in stage II hypertension, which led to a significant decrease in the index of the ratio of maximum filling rate to maximum ejection rate (MSE) in these patients. In addition, this type of diastolic dysfunction was associated with a shortening of isovolumic relaxation time (IVRT). With the development of stage III hypertension, there is a significant predominance of patients with a restrictive type of diastole disorder. At the same time, there was an increase in the maximum filling rate and a decrease in the contractility of the right ventricle. The index of the ratio of the maximum filling rate to the maximum expulsion rate increased significantly. In patients with stage III hypertension, the formation of a restrictive type of diastolic disturbances also influenced the time parameters of diastole.

Conclusions. Thus, with the addition of heart failure, patients at various stages of hypertension develop more severe RV DD, in some cases of a restrictive nature. In patients with severe heart failure, a decrease in the contractility of the right ventricle is detected, which consisted of a significant decrease in MSI and maximum ejection rate, a trend towards a decrease in stroke volume and an increase in RV EDV.

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